

## ABSTRACT OF THE DISCLOSURE

A device for separating particles according to their respective masses includes a substantially cylindrical wall of inner radius, " $R_{\text{wall}}$ ", that surrounds a chamber and defines a longitudinal axis. A multi-species plasma having relatively cold ions is initiated at a first end of the chamber within a relatively small radius, " $r_{\text{source}}$ ", from the longitudinal axis. A hollow cylinder having an outer radius, " $R_{\text{outer}}$ ", is positioned at the second end of the chamber and centered on the axis. Cross electric and magnetic fields ( $E \times B$ ) are established in the chamber that are configured to send ions of relatively high mass on trajectories having a radial apogee,  $r_{\text{apogee}}$ , that is greater than the cylinder's outer radius ( $r > R_{\text{outer}}$ ). After reaching apogee, these ions lose energy and strike the cylinder where they are collected. Low mass ions are placed on small radius helical trajectories and pass through the hollow cylinder.